TOLL PAYMENT SERVICE VIA WIRELESS COMMUNICATION NETWORKS

FIELD OF THE INVENTION

[0001] The present invention relates to the art of telecommunications in general, and, more particularly, to a method and system for paying highway tolls via wireless communication networks and devices.

BACKGROUND OF THE INVENTION

[0002] Electronic toll collection systems for tollways are well known. One such system is I-PASS, which is the Illinois Tollway's Electronic Toll Collection Program. With I-PASS, users of the Illinois Tollway may open an account that allows for travel through the toll plazas faster, often without stopping, and no cash toll payments.

[0003] Typically, I-PASS users pay a refundable security deposit for the use of the equipment and then prepay their tolls into an account. As the user drives through the toll collection lanes, the individual toll at that location is electronically deducted from their prepaid toll balance. Motorists, who choose, may also sign up for automatic replenishment by credit card so that when their account balance falls below a certain minimum, replenishment is credited to their account. However, this process may take up to twenty-four hours.

[0004] A user may open an I-PASS account with a credit card or check. The account is typically set up as a prepaid debit account wherein the user must maintain a positive balance in the account at all times. Once an account is opened, the user is issued a small device called a "transponder." This transponder communicates through radio signals with the toll plazas as the user drives through the toll plazas.

Account information is sent back and forth between the transponder and the plaza, and the user's prepaid toll balance is debited. The transponder generally mounts to the vehicle's windshield, right behind the rearview mirror. It may be mounted on dualock (Velcro-like) strips and is generally removable so that it can be moved from car to car.

[0005] There is no interaction between the user and the transponder; all functionality happens electronically. When approaching a toll plaza, the user can use any toll collection lane, including the I-PASS dedicated lanes. In most cases, as the user drives through the lanes, a blue light will be activated. This means the user's I-PASS transaction has been successfully completed. A yellow light may also be activated, indicating that the user's account balance has fallen below the minimum amount and that steps will need to be taken to immediately replenish the account.

[0006] However, there are some drawbacks to such services. For instance, the sign-up process may be too slow for some people, and it does require users to pick up a separate device (the transponder) for their car in person or wait for it to be shipped to their home or office. Thus, a delay results in many cases between the decision to subscribe to the service and activation of the service for use.

[0007] Thus, there is a need for a fast and convenient method for subscribing to, activating, and paying tolls via wireless communication networks and devices. Wireless communication networks are well known and allow mobile devices to communicate with each other and other networks, including the Internet and the public switched telephone network.

SUMMARY OF THE INVENTION

[0008] In accordance with one aspect of the present invention, a method of processing toll payments for a motorist having a wireless communication device and a billing account with a wireless service provider, via a wireless communication network, is provided. The method includes sensing that the motorist is within range of a base station for a toll plaza having a given toll that is to be paid by the motorist; determining via a mobile switching center whether the motorist has activated a wireless toll payment service associated with the communication device; evaluating via the mobile switching center whether the subscriber has pre-selected a combined billing option for the account, where it has been determined that the service has been activated by the subscriber; sending a charge transaction from the mobile switching center to a toll payment system, where the motorist has not selected the combined billing option, the charge transaction indicating that the toll has not been paid by the motorist; and generating a billing record for the motorist at the mobile switching center and sending a non-charge transaction from the mobile switching center to a toll payment system, where the motorist has selected the combined billing option, the non-charge transaction indicating that the toll has been billed to the motorist via the wireless service provider of the motorist.

[0009] In accordance with another aspect of the present invention, a system for processing toll payments for a motorist having a wireless communication device and a wireless billing account with a wireless service provider is provided. The system includes means for sensing that the motorist having a communication device is within range of a base station for a toll plaza having a given toll that is to be paid by the motorist; means for determining at a mobile switching center whether the motorist has activated a wireless toll payment service associated with the

communication device; means for evaluating at the mobile switching center whether the subscriber has pre-selected a combined billing option for the account, where it has been determined that the service has been activated by the subscriber; means for sending a charge transaction from the mobile switching center to a toll payment system, where the motorist has not selected the combined billing option, the charge transaction indicating that the toll has not been paid by the motorist; and means for generating a billing record for the motorist at the mobile switching center and sending a non-charge transaction from the mobile switching center to a toll payment system, where the motorist has selected the combined billing option, the non-charge transaction indicating that the toll has been billed to the motorist via the wireless service provider of the motorist.

[0010] An object of the present invention is to provide a fast and convenient process for subscribing to, activating, and paying tolls via wireless communication networks and devices.

[0011] Still further advantages and benefits of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the present specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the invention.

[0013] FIG. **1** is a block diagram showing a wireless communication environment suitable for practicing aspects of the present invention.

[0014] FIG. **2** is a flow chart illustrating a process for handling subscriptions to a wireless toll payment service in accordance with an aspect of the present invention.

[0015] FIG. **3** is a flow chart illustrating a process for handling activation of the wireless toll payment service in accordance with an aspect of the present invention.

[0016] FIG. **4** is a flow chart illustrating a process for implementing the wireless toll payment service in accordance with an aspect of the present invention.

[0017] FIG. **5** is memory layout of data stored in the subscriber database in accordance with an aspect of the present invention.

[0018] FIG. **6** is memory layout of data stored in the billing database in accordance with an aspect of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] It is to be understood that the specific methods and systems illustrated in the attached drawings and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Therefore, specific examples and characteristics related to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0020] FIG. **1** is a block diagram of a wireless communication network **10** in which the present invention may be implemented. The network **10** preferably includes one or more of a mobile switching center **12**, a billing database **14**, a subscriber database **16**, a base station **18**, a toll plaza **20**, a wireless communication device **22**, and a toll payment system **24**. It is to be understood, however, that the network **10** may incorporate other elements as well.

[0021] The base station **18** is generally a central radio transmitter/receiver that maintains communications with the wireless communication devices **22** within a given range (typically a cell site). The base station **18** is coupled to the mobile switching center (MSC) **12**, which is generally a switch that provides services and coordination between mobile users in a network and external networks.

[0022] The communication device **22** is generally a wireless device that includes a user interface and an interface for coupling to a radio access network (RAN). The user interface of the communication device **22** is typically referred to as terminal equipment and generally includes an audio interface, such as a microphone and speakers, a visual interface, such as a display, and a user input interface, such as a keyboard or touch pad. The interface for coupling to the RAN is typically referred to as a mobile terminal and generally includes an over-the-air interface for transmitting and receiving data. The over-the-air interface of communication device **22** is used to communicate with the base station **18** in the RAN. The communication device **22** and the base station **18** in the RAN may communicate over-the-air using various transmission methods, including a packet-based protocol.

[0023] The toll payment system **24** may be a state-wide (such as I-PASS), a regional, or a national system. Although not shown in the figure, the toll payment system **24** may include any number of elements as are known in the art for providing toll payment services to subscribers, including a reading device, subscriber databases, and computer systems for debiting, crediting subscriber accounts based on records created from the transponder reading devices.

[0024] In the preferred embodiment, the MSC **12** is a processor-based apparatus with data link interfaces for coupling together as described above and shown in FIG. **1**. The MSC **12** includes one or more processors that execute

programs to implement the functionality described herein and generally associated with wireless systems. The flexibility of this processor-based system permits ready integration into this system of a wireless toll payment method and system in accordance with the present invention.

[0025] With reference now to FIG. **2**, a preferred method **100** of subscribing to a wireless toll payment service/feature is shown. It is understood that the method **100** may be implemented through software distributed throughout the network **10**, but preferably through software in the MSC **12**.

[0026] In step **102**, a communication/signal is received, preferably at the MSC **12**, from the communication device **22** via the base station **18**. The communication may be initiated in the usual manner, *e.g.*, by dialing a phone number, by entering a feature activation code (*e.g.,* *77), or through a Web site. The MSC **12** recognizes that the communication is from the base station **18** and then determines whether the communication is a request to subscribe or unsubscribe to a wireless toll payment service (step **104**), based upon data contained in the communication. If the request is to unsubscribe to a wireless toll payment service, then the network **10**, preferably via the MSC **12**, updates the subscriber's data in the subscriber database **16** to reflect that the subscriber in question has unsubscribed to the toll payment service (step **106**).

[0027] Accordingly, the subscriber database **16** typically includes a number of data sub-blocks for each subscriber. These are shown in FIG. **5**. They are shown as a super block **400,** not all of whose fields are filled for a particular subscriber. The super block, as known in the art, can be accessed from the identity of any one of several fields in the super block. The super block **400** includes the following data sub-blocks: a block **402** contains basic subscriber data; a block **404** contains toll

payment service subscription data; and a block **406** contains toll payment service activation data. Any number of additional blocks **408** may be provided in the super block **400** for storing additional subscriber data.

[0028] Returning now to the method **100**, in step **108**, the MSC **12** then notifies the toll payment system **24** of the dropped subscription. If the communication received is a subscription request, then the MSC **12** updates the subscriber data in the subscriber database **16** to reflect that the service has been subscribed to and updates the feature parameters (step **110**). The MSC **12** then notifies the toll payment system **24** of the new subscription (step **112**).

[0029] With reference now to FIG. **3**, a method **200** of handling requests for activation/deactivation of the wireless toll payment service is shown. It is understood that the method **100** may be implemented through software throughout the network **10**, but preferably through software in the MSC **12**.

[0030] In step **202**, a wireless subscriber initiates an activation (or deactivation) request of the toll payment service in the usual manner, *e.g.*, by dialing a phone number, by entering a feature activation code, or through a Web site. Next, the MSC **12** receives a communication via the base station **18**, and determines whether a service activation/deactivation request has been transmitted, based upon data in the communication (step **204**). If a service deactivation request is received, the MSC **12** then updates the subscriber data in the subscriber database **16** to reflect that the service is not currently active (step **206**). Otherwise, the MSC **12** updates the subscriber data in the subscriber database **16** to reflect that the service is currently active (step **208**).

[0031] With reference now to FIG. **4**, a method **300** of implementing the wireless toll payment service for a particular subscriber is shown. It is understood

that the method **100** may be implemented through software throughout the network **10**, but preferably through software in the MSC **12**.

[0032] In step **302**, a wireless subscriber approaches the toll plaza **20**. The base station **18** will automatically communicate with the communication device **22**, if it is turned on. Preferably, the base station **18** is a dedicated base station. That is, the base station **18** has a small RF footprint.

[0033] The communication is then transmitted from the base station **18** to the MSC **12**, and a determination is made by the MSC **12** as to whether the service is active for the subscriber (step **304**). If not, the MSC **12** may send a text message to the subscriber's communication device **22**, indicating, for example, that the service is not active and that the wireless toll payment account has not been charged (step **306**). Otherwise, the MSC **12** determines whether the subscriber has selected a combined billing option as stored in the subscriber database **16** (step **308**).

[0034] The subscriber may select a combined billing option when signing up for the wireless toll payment service. That is, the subscriber may choose to have all toll charges processed by the wireless service provider, which charges would then show up on the subscriber's wireless bill. In that situation, the wireless service provider would send payment directly to the toll payment system on behalf of the subscriber, according to a pre-arranged agreement between the wireless service provider and the toll payment system.

[0035] If the subscriber has not selected the combined billing option, then the MSC **12** sends the toll payment system **24** a charge transaction for the subscriber (step **310**). However, if the subscriber has selected the combined billing option, then the MSC **12** sends the toll payment system **24** a non-charge transaction for the

subscriber (step **312**). The network **10** then generates a mobile billing record for the amount of the toll charge and stores it in the billing database **14** (step **314**).

[0036] The billing database **14** includes a number of data sub-blocks for each subscriber. These are shown in FIG. **6**. They are shown as a super block **500** not all of whose fields are filled for a particular subscriber. The super block, as known in the art, can be accessed from the identity of any one of several fields in the super block. The super block **500** includes a data sub-block **502**, which contains basic subscriber billing data and a data sub-block **504**, which contains toll payment service billing data. Any number of sub-blocks **506** may be provided in the super block **500** for storing additional subscriber billing data.

[0037] Thus, in accordance with the present invention, a subscriber may simply (1) make a call to a wireless service provider to subscribe to a wireless toll payment service via a mobile phone, (2) activate the wireless toll payment service with the mobile phone, and (3) drive through a properly equipped toll collection plaza with their mobile phone turned on. The toll collection plaza would then recognize that the mobile device approaching the plaza is associated with a subscriber to the wireless toll payment service who has activated such service. In turn, data concerning the transaction would be sent to the toll payment system, and the subscriber's account would be properly billed.

[0038] Alternatively, a user may be able to purchase or lease a wireless communication device that has been adapted to work with the wireless toll payment service, as described above. Such a modified device would include a transponder, similar to the one available through I-PASS, built into it. The device, when it is turned on and the subscriber's account is suitably credited, may be able to communicate with the toll plaza, in order to process payment for the toll.

[0039] The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description of the preferred embodiments. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalence thereof.